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ABSTRACT

Although designed to process personal reference collections maintained by researchers, Famulus is suitable for a large number of other applications. For this purpose it can be regarded as a general-purpose system. This manual presents it as such a system. The eight main Famulus programs described are: "Edit"--writes punched card input onto tape. Allows the user to make corrections, additions, and deletions. "Sort"--rearranges file order by changing the order of fields within records so the file can be realphabetized. "Merge"--provides updating facilities and permits enlargement of the files through merging two individual files into one master file. "Galley"--prints the file in any of several formats. "Vocab"--prints in alphabetic order the words in any given field of a file, making lists of index terms, keywords in title, etc. "Index"--lists keywords and tells in what records they may be found, thereby, indexing your file. "Search"--scans stipulated field(s) in the records of a file, matching them against a user-prepared search question. Only those records that meet the search requirements are printed out. "Ossify"--punches card deck equivalents of tape files, for use as safety decks or for massive correction operations. Appendix D mentions three peripheral programs. (Author/NH)

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FAMULUS:

a personal documentation system...

USERS' MANUAL

LI 002 988

1969

FOREST SERVICE
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PACIFIC SOUTHWEST
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FOREWORD

FAMULUS was conceived by Theodor B. Yerke, Station Librarian, as a personal documentation system for research scientists. The system provides extreme individual freedome to structure and update information files maintained by individuals. Interchange and merger of files between individuals or groups is also easily accomplished. Mr. Yerke worked closely with Robert M. Russell, senior programmer, in the development of a prototype system. In July 1967 the Research Branch of the Forest Service, Washington, D.C., agreed to support development of a more versatile system, in view of its service-wide adaptability.

An informal FAMULUS group was set up with Mr. Yerke as chairman. Robert M. Russell was assigned programming responsibility. In the year that Mr. Yerke was at Harvard University, Mrs. Hilary Burton, Computer Services Librarian, worked closely with Mr. Russell in development of features which work with pioneer users had shown to be desirable. William G. O'Regan and Clyde M. Walker, Branch Chiefs respectively of Biometrics and Information Services, gave technical and policy advice. The IBM 360 conversion from the original CDC 6400 program was done under contract at the University of California, Los Angeles, Campus Computer Network by Jerry Pine, with supervision from Kenneth Tom, the Network's Assistant Director .

Potential FAMULUS users should make preliminary enquiry to Mr. James Clarke, who is in charge of the Computer Services Library. He will provide technical details and establish liaison with user's computing facilities.

ROBERT D. McCULLEY
Director

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APPLICATIONS

Famulus is designed to process personal reference collections maintained by researchers*. However, its basic structure renders it suitable for a large number of other applications. For this purpose it can be regarded as a general-purpose text-handling system. This manual presents it as such a system. For that reason, the term record is used instead of citation, and file instead of collection. However, messages emitted by the programs use the words "citation" and "tape".

Famulus will maintain many types of information files which can be broken into units or records with sub-categories or fields which can be identified. In a personnel information file, the data on each person comprises one record. The record may have up to 10 distinct fields in which are entered name, date of birth, job title, etc. In bibliographic files, the citation is the record, and fields are used for author, title, date, keywords, abstracts, etc.

The eight main Famulus programs are described in this manual. Three peripheral programs are mentioned in Appendix D. The principal programs and their functions are:

Edit--writes punched card input onto tape. Allows the user to make corrections, additions, and deletions.

Sort--rearranges file order by changing the order of fields within records so the file can be realphabetized.

Merge--provides updating facilities and permits enlargement of the files through merging two individual files into one master file.

Galley--prints the file in any of several formats.

Vocab--prints in alphabetic order the words in any given field of a file, making lists of index terms, keywords in title, etc.

Index--lists keywords and tells in what records they may be found, thereby, indexing your file.

Search--scans stipulated field(s) in the records of a file, matching them against a user-prepared search question. Only those records that meet the search requirements are printed out.

Ossify--punches card deck equivalents of tape files, for use as safety decks or for massive correction operations.

*For a discussion of this Famulus application see USDA Forest Service Research Note PSW-193: Burton, H. D., Russell, R. M., Yerke, T. B. FAMULUS: a computer-based system for augmenting personal documentation efforts.

RECORD STRUCTURE

Famulus accepts input records up to 4,000 characters in length with ten or fewer fields per record. Fields may vary in length but the total record cannot exceed the 4,000-character limit. There is no actual limit on how many records Famulus can handle. Where large files exist, Famulus can operate on portions and then merge them into a master file. Beyond the range of 3,000-5,000 records, depending on average length of each record, it is more efficient to divide the file into sections.

COMPUTER COMPATIBILITY

Famulus is currently operational on several computers: the Control Data Corporation 6400 and 6600; the IBM 360, Model 40 and larger; and the Univac 1108. Program control cards* are the same for each computer. System control cards such as tape request cards, 360 job control language, job accounting cards, etc., will vary from computer to computer even when the model is the same. Potential Famulus users should contact the Famulus System Administrator stipulating the model and size of machine on which they would like to use Famulus. The System Administrator will contact the user's Computer Center and make necessary enquiry, supplying both the user and Center will appropriate documentation.

PREPARING INPUT

Before files can be keypunched for Famulus processing, some basic decisions must be made. Most fundamental is to determine how the records are going to be divided into fields, how many fields are needed, and what they will be labeled.

The avenues of access to each record, or to parts of a record, are determined by the way the record is broken into fields and by the content in each field. Determination of fields is thus synonymous with selection of access points to the record in the file.

---

*Cards read only by Famulus and used to define the parameters of the file being processed. See Appendix B for samples.

You must decide what access points you want to the items in your collection. Then you can label your fields. Labels may be up to four characters in length, must begin with an alphabetic character, and may not include special characters such as punctuation:

PUBL (legal field label)
PUB. (illegal field label)

For the sake of compatibility, if less than 10 fields are selected, it is wise to make dummy labels for the unused fields. You cannot change the number of fields originally declared; therefore, if you declare only seven fields and decide you need an eighth, you will have to rewrite all the cards on to tape again. However, if the 10 fields are declared, the unused three fields are always available yet they cause neither extra punching nor additional processing time. Cards are punched only for fields with information present.

ADDING KEYWORDS

If you expect to use the information retrieval and indexing features of Famulus (the Search and Index programs) you must allocate a field for descriptors (see Appendix E). Bibliographic and many other kinds of records will rely heavily on the quality of assigned descriptors. Some types of records can be handled adequately without descriptors by relying on the sorting and listing features of Famulus. Descriptors can be drawn from standard subject term lists (see Appendix E), from the titles of bibliographic records, or they may be devised by the user.

ABSTRACTS AND NOTES

You may want to include abstracts or notes in your record structure. If so, a field can be designated for this function. Since fields can be of any length, so long as the total for all fields is within the 4,000-character record limit, you may easily include abstracts or notes of 300 or more words. Three-hundred words take 1,800 to 1,900 characters; this still leaves space for over 2,000 characters of information in other fields. Existing Famulus-based collections include several with abstracts ranging from 150-to-300 words per record, while some users prefer only two- to three-sentence resumés, or none at all. Naturally, longer abstracts will increase processing time and, thus, cost.

FLEXIBILITY

Famulus is designed to allow the maximum possible flexibility in user adaptation. Any kind of non-tabular written information can be processed. Structuring of the file is user-defined, and format for keypunching is extremely simple. Once the user understands the basic operations of Famulus and how to accomplish them, he can use the more sophisticated features in conjunction with the basic tools to provide himself with individual, tailor-made information handling and processing services.

A description of the functions performed by the main programs and how to use them follows, and the manual concludes with appendices.

FAMULUS PROGRAMS

EDIT

The Edit program performs the primary data-handling and data-editing chores of Famulus. When the program reads card input, it simultaneously transcribes error-free records onto magnetic tape and prints each record on printout paper. If it detects a format error in a record, that record is not written on the tape. It is only printed on the paper, set off by asterisks for quick spotting and accompanied by an error message (see Appendix C).

Before Edit reads any cards punched with record information, it reads the system and program control cards which must be at the head of the deck. The program control cards provide the name of the file, the list of field labels, and the name of the descriptor field. This information is written on the tape first. Subsequent use of the tape requires that the Famulus program match the /ID/ card supplied in the program control deck with the /ID/ information written on the tape being used.

A tape created by Edit becomes the input for all other Famulus programs. There is no need to use the card deck(s) again. The most common error in preparing card decks for Edit is the omission of the blank card which must separate each record from the following record. If the card is left out, two records will be regarded as a run-on record and both records will be rejected.

The next program control card which Edit reads establishes the field order for all records in a given file. This information is on the /FIELDS/ card which lists the field labels in their order of occurrence in each record. If fields in a record are not in order, or if a field label is mispunched, the record is rejected with an accompanying message explaining the error. Missing fields within a record are ignored. This feature is necessary since not every record or citation in a file will require all the allowable fields. However, for the fields which are present, their order must match that outlined on the /FIELDS/ card.

After the file has been put on tape, changes in the file identification or field labels are easily handled by subsequent Edit runs. To change the file name the /ID/ card matching the existing tape name is followed by a /NEW ID/ card containing the new name. In the case of the field labels, sim-

ply use a regular /FIELDS/ card giving the desired new labels. It is not necessary to include both in this operation. Edit will change the existing list of field labels to match the new list. Changing labels by the /FIELDS/ card must not be confused with the changing of the order of fields. That is done by the Sort program.

In declaring the fields for a given file, it is wise to declare the maximum ten fields even if you do not need that many. You may at some later date want to add one or more fields. If you have declared only six fields, you cannot simply add two more to the record format. The entire tape must be rewritten using a new /FIELDS/ card. But if you have declared all ten fields, labeling the last four DUM7, DUM8, etc. (for dummy), the fields are already there in the format and can be filled with the added record information. You only need to relabel the fields, as described above. Dummy fields, although declared on the initial identification record and present on the /FIELDS/ card, require no extra punching, since, if a field is not present in a record, it is simply skipped over. Blank cards are not needed for blank fields.

Edit also provides the user with facilities for updating files via corrections, deletions, and/or additions. Corrections are accomplished via the /REPLACE/ card on which the old information is punched followed by the new information which is to replace it. Up to 100 replacements can be made during a single Edit run. A replacement may effect as little as one letter of a word or it may replace all the words in a field. Each change, regardless of length, counts as one replacement. In order to remove records from the collection, simply use a /DELETE/ card followed by the citation number to be deleted.

It is possible to add new records to a file using the Edit program, but this method is not efficient if the master file is already large. Edit adds new citations to a collection by rewriting the input tape and simply adding on the new citations following the old. This new tape is obviously not in any order and must be run through the Sort program. Therefore, if the collection is sizeable, it is more efficient to use Edit to write the new citations onto a separate tape, to sort the additions into the same order as the master file (i.e., by author, by title, by job type, etc.), and then to merge the two tapes. However, when there are only several hundred citations on a tape and less than that are being added, it is feasible to use the Edit program in the manner described above to add on the new items. Also, if obtaining the output in a minimum amount of time is a factor, then using Edit without Merge to update the collection is desirable.

Following is a description of the control cards which Edit accepts and how to use them:

/ID/ Card

Punching begins in column 1 with the control statement /ID/. The file name follows the second slash and extends to column 80, if necessary. If the name is more than one card in length, the continuation should begin in column 1 of the second card. The file name can be up to 100 characters in length. Blanks before and after the file name do not count. All subsequent use of any tape by any Famulus program requires an /ID/ card which exactly matches the identification written on the tape. It is always a good idea to make several copies of the /ID/ card and retain them for later use. In every program, the /ID/ card must be the first program control card.

```
/ID/LAB NOTES--PATHOLOGY PROJECT
/ID/PACIFIC SOUTHWEST EXPERIMENT STATION LIBRARY CATALOG
```

/NEW ID/ Card

To change the name of a tape, prepare a /NEW ID/ card bearing the new tape name. This is placed in the control deck after the /ID/ card bearing the present name of the tape. Edit will relabel the tape. The next time you use this tape, the /ID/ card will have to be punched with the new name. Punching for the /NEW ID/ card is the same as for the /ID/ card.

```
/NEW ID/PROJECT REFERENCE COLLECTION
```

/FIELDS/ Card

This card defines the field structure of all records on your tape. It establishes field labels, order, and number. You may have up to 10 fields, naming them as you wish. Each label must begin with an alphabetic character and may be up to four characters long. The other characters may be either letters or numbers, but not special characters such as punctuation. Two fields may not have the same name. It is wise to declare all ten fields on the /FIELDS/ card even if several of them are only dummy fields. Then, if you later decide to add new information, fields are available. Although field labels may be changed simply by using different labels on the /FIELDS/ card during an Edit run, the number of fields declared cannot be changed. The only way to declare more

fields is to punch out the collection (using Ossify) and re-enter it on tape using Edit and a /FIELDS/ card indicating the new number of fields.

The /FIELDS/ card sets the order in which the information in a record should occur on an Edit tape. If the input cards contain field labels not in the same order as called for by the /FIELDS/ card, the Edit program will assume the cards are out of order. It will skip them and print an appropriate error message. However, once the fields are declared, a record with fields missing, but with the existing fields in the proper order, will be valid.

One of your fields may be designated as the descriptor field. Famulus programs regard the contents of a descriptor field differently from the contents of other fields. In every other field words are recognized as such when they are separated by blanks. But in a declared descriptor field the program does not look for words separated by blanks. It searches for units separated by commas. This makes possible the inclusion of index terms consisting of multi-word phrases.

A descriptor field consisting of the terms SAWLOGS, BLUE SAP STAIN, and SCALING will be regarded by Index, Vocab, and Search as having three recognizable terms. This presents a problem since the phrase BLUE SAP STAIN in a descriptor field is handled as though it were one large word. If you were using Search with a descriptor SAP STAIN, it would not recognize "sap stain" in the phrase "blue sap stain" and you would not retrieve this item. In other fields, such as the title field, Search can recognize the term "sap stain" in the phrase "blue sap stain".

/ORIGINAL/ Card

This card is required in the control deck when you are starting a new file. Edit will accept both card and tape input. The /ORIGINAL/ card tells Edit that there is no tape input and to begin to write the card input immediately on the output tape. When there is no /ORIGINAL/ card in the deck, Edit expects tape input as well as card input. It will first process the tape input, transferring it to the output tape. Then it will process the cards, adding their content to the output tape last. If there is only card input, but no /ORIGINAL/ card, Edit will issue an error message. The only situation in which Edit is not fail-safe occurs when an /ORIGINAL/ card is accidently left in the control deck when there is also tape input. This could result in your wiping out the original file.

/CITATIONS/ Card

The /CITATIONS/ card indicates to Edit that new records on cards follow. This card should always be the last program control statement in the deck and should be immediately followed by the record cards.

/REPLACE/ Card

This Famulus feature allows you to change portions of any record in your file. You can replace one letter in a word, several words, or the entire field. The /REPLACE/ statement requires four pieces of information:

(1) the record number
(2) the field within the record to be changed
(3) the part of the field to be changed
(4) the new material to be inserted

The record number is shown on Edit or Galley listings of the tape concerned. Corrections are always made to the sorted, most current tape of your file. You may find it easier to make corrections from the Edit listing, which shows the field labels.

On the /REPLACE/ card the record number and the field label are each enclosed in parentheses. An asterisk follows the last parentheses of the field label. The information to be replaced is punched in and terminated by a second asterisk. The new information immediately follows and is closed by the third asterisk. Edit finds the record number on the tape, scans the cited field for the characters enclosed between the first and second asterisks and replaces them with the characters included between the second and third asterisks. You do not have to worry if the lengths of the two strings are not the same. Unequal lengths are no problem for Edit.

The /REPLACE/ statement also can be used for deletions only and additions only. For deletions, the characters to be removed from a field are inserted between the first and second asterisks. The third asterisk is punched immediately after the second asterisk, (i.e., the "new information field" is empty). To add material without deleting, the first and second asterisks are punched one following the other, and the new material is added on and closed with the third asterisk. Up to 100 replacements may be made in one Edit run.

```
/REPLACE/(1)(AUTH)*SMITHH*SMITH*
```

(Changes SMITHH to SMITH in the author field of record 1.)

```
(2)(TITL)*MATHIMATICAL*MATHEMATICAL*
```

(Changes MATHIMATICAL to MATHEMATICAL in the title field of record 2.)

```
(5)(ABST)**THIS PAPER INCLUDES A DISCUSSION OF
CURRENTLY IMPLEMENTED LINEAR PROGRAMMING TECHNIQUES
AVAILABLE FOR THE IBM 360.*
```

(Adds an abstract to citation 5.)

```
(120-127)(A)*MACPHEE,*MAC PHEE,*
```

(Changes author's name from MACPHEE to MAC PHEE in eight consecutive citations.)

If there are two changes to be made within the same field, with considerable information separating them, make two statements, each one giving the record number and field label.

If you are using the one-card-per-correction approach, which is most useful when numerous corrections are to be made, and if a correction extends more than 80 characters, simply continue it onto column 1 of another card, beginning the subsequent correction on a new card in column 1. The corrections can also be punched as a string, as follows:

```
/REPLACE/(1)(AUTH)*INCORRECT INFORMATION*CORRECT INFORMATION*
(2)(TITL)**INFORMATION TO BE ADDED*(5)(AUTH)*MATERIAL TO BE
DELETED**(9)(ABS)**NEW MATERIAL TO BE ADDED*(25)(AUTH)*
INCORRECT*CORRECT*(25)(TITL)*INCORRECT*CORRECT*
```

Regardless of the format being used, the actual statement /REPLACE/ occurs only once per job. It must not precede each correction. It appears only as the very first statement and all corrections, additions, etc., follow it.

Edit must be given enough information in a /REPLACE/ statement to identify a unique piece of information. Therefore, if a word occurs more than once in a field and you wish to change only one occurrence of it, include enough preceding or following characters for Edit to distinguish between the two occurrences.

/DELETE/ Card

To delete whole records, simply punch /DELETE/ and follow it immediately by the series of record numbers to be deleted, enclosed by parentheses. If a group of records is to be deleted, such as numbers 15 through 25, you may punch (15-25). The individual record numbers of sequence should be separated by commas. Up to 500 record numbers may appear.

/DELETE/(2, 7, 29, 215-221, 864)

/PRINT/ Card

This statement is used to print portions of the file which Edit otherwise would not print. For instance, if records are being added to an existing file, Edit would normally only print the new records, skipping over the original file. If there were 243 records on tape, and 75 new records were added, the Edit printout would begin with record no. 244 and list only those new records which were error free. During a run to correct or change records, Edit will normally only print those records in which changes have been made. In order to receive a complete listing of the file, the print statement must be used. Following the /PRINT/ statement should be the numbers of the records to be printed, enclosed in parentheses. For the above example, if the statement /PRINT/(1-243) had been included in the job, the entire file would be printed. Any portion of the file can be printed using the print statement, but some sequence of numbers must occur after /PRINT/. If only the statement is used without appropriate record numbers, it will be ignored.

No more than 100 individual record numbers may appear in the list. This limit applies to all such lists (/PRINT/, /REPLACE/, /PUNCH/, /SELECT/) except /DELETE/, above, which accepts 500.

The next example shows a list including six record numbers:

/PRINT/(13, 74-81, 83, 123-125)

The computer regards the notation 74-81 as one number, likewise 123-125, even though thirteen actual citations are printed by these two instructions.

SORT

Sort rearranges the order of records in a file according to your instructions. Most common use of Sort is to obtain an alphabetical listing of bibliographic records by author or title. However, Sort can reorder records into any specified arrangement. All of the allowable ten fields may be reordered if desired, or a simple alphabetical sorting using only one field as the key can be made. The desired ordering of the records is accomplished by a /FIELDS/ card indicating the sorting precedence of the fields. If only an alphabetical listing by author is desired, then the /FIELDS/ card might be: /FIELDS/(AUTH,TITL). The second field is put in so that in the event of two identical authors, the Sort can be resolved on the basis of the titles. Any fields not specifed on the /FIELDS/ card will remain in the order existing on the input tape.

Output for the Sort program consists of a listing of the program control cards, and a technical record of the number of groups of records which were processed. This is followed by three large OK's if the processing was completed successfully. The body of sorted records is not printed. Galley, the Famulus printing program, will print the newly sorted file. A description of the control cards acceptable to Sort follows:

/ID/ Card

The /ID/ card matching the file name written on the tape must be the first program control card.

/FIELDS/ Card

This card specifies the order into which the fields are to be rearranged. Immediately following the /FIELDS/ card should come the labels of the fields to be sorted on, arranged in the desired order and enclosed in parentheses. Those fields not specified on the /FIELDS/ card will remain in the order they exist on the input tape. The /FIELDS/ card may include as many as ten or as few as one field label. Punching of the control card begins in column 1 and continues as far as necessary with each label separated by commas. No more than one card is ever necessary for a /FIELDS/ statement.

```
/FIELDS/(AUTH,TITL,DATE)
/FIELDS/(A,B,D,F)
```

/SELECT/ Card

This card is used to break large files into sections for more efficient sorting. If your file exceeds 3,000 records, it is more efficient to sort the first half in one run, then sort the second half, and then merge the two output tapes. For collections exceeding 8- or 9,000 records, it is more efficient to break the file into three sections, and so on. Control card punching begins in column 1 and following /SELECT/ is the sequence to be sorted enclosed in parentheses. For example:

```
/SELECT/(1-1500)
/SELECT/(1501-3200)
```

To sort the entire file, omit /SELECT/.

MERGE

This program provides the updating facility for Famulus-controlled files. It merges any "master tape" with an "additions tape". Merge can be used for two purposes--to update files by merging information from two tapes onto one output tape, or to join files belonging to two or more persons. For instance, the various members of a working group may maintain separate literature files, but on occasion they may wish to make a master listing of all these files.

Merge will only accept input files having the same number of fields; however, the field names do not have to be the same. The master tape, referred to as TAPE1, and the additions tape, referred to as TAPE2, will be merged and written onto TAPE3. The field labels on the output or updated tape will be the same as those occurring on TAPE1. The /ID/ will also be taken from TAPE1, unless a /NEW ID/ statement is included.

Any record which is not in correct alphabetical order will cause the Merge program to halt processing, reject the remainder of the job, and print an error message. Therefore, only tapes which have been ordered in the same way by the Sort program should be input to Merge. Unless specifically requested, Merge does not print out the file. It prints the /ID/ of the master tape, the /ID/ of the additions tape, and the /ID/ of the output tape along with the field labels for each. This will be followed by the number of records on the newly updated tape and the familiar three large OK's.

The program control cards acceptable to Merge are:

/ID/ Card

An /ID/ card for the master tape (TAPE1) and an /ID/ card for the additions tape (TAPE2), in that order, are mandatory. If a different /ID/ is desired for the output tape, then a /NEW ID/ should be included.

/PRINT/ Card

If this statement is included exactly as shown above the entire collection will be printed 128 columns wide. If a different page width is desired, then the selected width (in columns) should be placed after the /PRINT/ enclosed in parentheses, e.g., /PRINT/(65) will produce a printout 65 columns wide, approximately notebook paper width.

GALLEY

Galley is the printing unit of Famulus. It recognizes only three types of program control cards:

/ID/ Card

This card must be present and must match the name of the tape file.

/SELECT/ Card

If present, this card allows the user to designate which records are to be printed. Any portion or portions of the collection may be selected.

For example:

```
/SELECT/(1-100, 750-1000, 1200-1500)
```

/WIDTH/ Card

This card allows the user to specify the printed-page width. It may range from 20 characters (columns) to 128. If the /WIDTH/ card is not used, the output will be printed 128 columns wide. There are ten characters per inch on the printout paper.

Galley prints the fields in sequence without starting a new line for each field, and also drops the field labels. An alternate format is provided by Edit, which separates the fields and attaches their labels. To do this, run Edit with only /ID/ and /PRINT/ cards.

INDEX

This program compiles an alphabetical index by scanning the descriptor field and printing each descriptor and a list of the record numbers where it occurs. Index operates only on the descriptor field. Descriptor words or phrases longer than 40 characters will be truncated during the printing of the index. The capacity of the program is limited to processing 2,000 different descriptors referenced up to 2,500 times. Index accepts the /SELECT/ card which allows the user to determine which portions of the collection shall be operated upon. Index also has a punch option, which allows the user to have the index punched out on cards. The card file for the various portions of the index can then be merged to provide a master index to the complete file.

Index program control cards are the following:

/ID/ Card

This card must match the file name as it was written on tape.

/SELECT/ Card

This card specifies the portion of the file to be indexed. The record numbers, for example 1-500, or 501-1000, should follow /SELECT/ and be enclosed in parentheses.

For example:

```
/SELECT/(1-500)
/SELECT/(501-1000)
```

/PUNCH/ Card

This statement is used by itself, without sequence numbers, to obtain the index as a punched card deck.

VOCAB

Vocab will scan any field(s) in your record file and compile an alphabetized list of terms occurring in the field(s). These lists can be used for editing purposes, for constructing search formulas, or for thesaurus building. A list of the words in the title field and a list of terms in the descriptor field is an effective subject outline of your collection. Using these lists, you can construct search formulas as explicit as you feel necessary. It is advisable to have a separate list of words for each field that Vocab compiles from. Vocab can compile one combined list from two or more fields, but you will not then know from which field a word is taken. Lack of this information will seriously impair your ability to design effective search formulas (see p. 35 *infra* "Constructing the Search Formula."

To exclude "meaningless" words, such as articles and prepositions, Vocab uses a stop-word feature. The stoplist consists of a deck of punched cards representing the terms to be excluded from the list. This deck must be used each time Vocab is run. Standard stop-word lists are available. You will also want to add words to such a list.

Vocab is not a self-starting program. Before it can compile a vocabulary list, it must have a token list of at least one word. The best procedure is to make a token list consisting of the first few meaningful words found in any record in the file.

Both the stop-word list and the token vocabulary list are part of the program control card input. However, these lists can be changed after each run. The Vocab program produces printed and punched output. The printed output consists of the alphabetical lists of words and a summary of word-length frequencies. The punched output consists of a newly punched stop-word list, and a card deck equivalent of the vocabulary list. This deck can be used as input to the next Vocab run or, if you prefer, you may make additions to the existing deck or develop an entirely new deck.

The control card input for Vocab consists of the stop-word and vocabulary deck, an /ID/ card, a /FIELDS/ card, and a /SELECT/ card. The /SELECT/ card allows the user to scan only part of the collection. This option is helpful when very large or heavily-indexed collections are being scanned. The dictionary limits on vocabulary size are either 4,500 entries or 45,000 characters, whichever is exceeded first. If more than one field is being scanned during a single job,

this limit can be quickly reached with only 1,500/2,000 citations. This is another reason for scanning one field per job. For very large files, scanning only one field per job can exceed the program's limits. When this happens, the /SELECT/ option is available. If Vocab's dictionary limits are exceeded, you can locate the point where capacity was reached. This is indicated by the message immediately preceding the statistics section (see Note at end of Vocab section) and following the actual word lists. The message indicates the last citation examined. By running another Vocab job using the /SELECT/ option, vocabulary for the remaining citations can be obtained.

The /ID/ card must identify the file to be scanned and therefore must match the /ID/ record written on the input tape. The /FIELDS/ card indicates the fields to be scanned. If omitted, only the descriptor field is scanned. Both the /FIELDS/ and /SELECT/ cards are punched the same as in Sort: punching begins in column 1, with the word /FIELDS/ or /SELECT/. Fields to be scanned follow in the fields card, enclosed in parentheses. Selected record numbers, enclosed in parentheses, follow on the /SELECT/ card. To scan the entire file, omit /SELECT/.

The vocabulary and stop-word lists are punched following a /VOCABULARY/ card which is punched beginning in column 1. The vocabulary words and the stop-words may be intermingled. The stop-words are distinguished by an asterisk (*) tacked on to the end of each stop-word. All entries are separated by commas. Blanks can be inserted anywhere except within a word. Punching continues from column 80 directly to column 1 of the next card.

To simplify matters, you may omit the comma following a stop-word because the asterisk suffices as a separator.

Note that stop-words do not occur in a descriptor field.

```
/VOCABULARY/A*AN*THE*OR*AND*GEOLOGY,SEDIMENTATION,
HYDROLOGY,REGRESSION ANALYSIS
```

Note

Explanation of STATISTICS FOR OUTPUT DICTIONARY section of Vocab output.

Two kinds of statistics occur--figures for the stop-words and figures for the actual vocabulary terms. The stop-word-length statistics are self-explanatory. For vocabulary terms, the table of word-length distributions gives the number of terms

of each length occurring in the fields scanned. The table is comprised of four rows and ten columns. The first row gives the values for terms having one to ten characters; the second, for 11 to 20 characters; the third, for 21 to 30 characters; and the fourth, for 31 to 40 characters. The average and maximum lengths of vocabulary entries are given along with total number of entries and total number of characters for the entries.

SEARCH

The information retrieval functions of Famulus are performed by Search, using terms drawn from sources such as Vocab lists, plus dates or authors as needed. The program scans your tape and retrieves (prints out) those records whose field content meet the criteria of the search question. The "question" is a "search formula", which is constructed according to Boolean principles (see Appendix F). Search will operate on any field in a record. In bibliographic records it will most likely be called upon to examine the descriptor field, the title field, and often the date and author fields.

A satisfactory search result depends on factors which are almost wholly in your control. You must have a clear concept of what you wish to retrieve from your file. Equally important is your understanding of how the search logic works and your skill in constructing search formulas. Efficiency and effectiveness of this task are fundamentally influenced by the quality and distribution of retrieval terms which you earlier assigned to records as you entered them into the file. Inept original indexing cannot be compensated for by the logic of the Search program.

Any field or combination of fields may be searched for any or all of the specified terms. Because of the flexibility of the program, there are usually several different search formulas which will retrieve the same set of records. Multiple searches can be executed by following the first search formula with a second, and so on. There is no limit to the number of searches which can be run in a single job. However, since the entire file is scanned for each search request, the cost is proportional to the number of searches.

Search provides the option of writing the retrieval set of records onto a tape for future use. Use of the Galley program will print this tape in regular format, or use of the print option in Edit will print it in Edit format with field labels included.

Program control cards acceptable to Search are the following:

/ID/ Card

This card must match the file name written on the tape to be searched.

/FIELDS/ Card

This card lists the field labels of the fields to be searched for retrieval terms. The labels should follow the /FIELDS/ statement and be enclosed in parentheses. If the entire record is to be searched (a very inefficient approach), no /FIELDS/ card is necessary. The /FIELDS/ card must precede the /SEARCH/ request.

```
/FIELDS/(TITL,DESC)
```

/WRITE TAPE/ Card

This statement causes the retrieved file to be written onto an output tape. The output tape must be accounted for in the tape requests included in the system control cards. This card must precede the search formula. If the card is omitted, no tape file is created. When /WRITE TAPE/ is used, only one /SEARCH/ request can be made.

```
/WRITE TAPE/
```

/SEARCH/ Card

The actual search formula follows this control statement. The terms used are joined by the logical operators *and*, *or*, and *not*. The logical operators have been programmed as the following card punch codes:

	Control Data Corp. 6400/6600 Code	IBM 360 Code	UNIVAC 1108 Code
and	0-8-7	12	11-8-3
or	11-0	12-8-7	11-8-7
not	12-8-6	11-8-7	12-8-7

There is no uniformity among keypunches, terminals, and computer printing units as to the symbols by which these numeric codes will be represented. Therefore, you cannot catch mis-punched logical operators by visual inspection of interpreted cards or other output. However, no matter what the printed conventional symbol may by, if the correct numeric code was punched, the desired logical operation will take place.

OSSIFY

Ossify will punch out a deck of cards from any Famulus-produced tape. The cards will be in the standard Famulus input format, with the field labels established by the most current Edit run. Ossify's principal use is to produce insurance decks in case the file record on magnetic tape is damaged or completely lost.

Under certain conditions, it may be less expensive to use Ossify for the correction of a badly organized file, particularly if the file has long fields, such as abstracts or text-storage which must be deleted or changed extensively. For instance, if for some reason many citations had incorrect abstracts or if the abstracts were punched with the wrong citation, or if several fields in each citation had errors, it would be far more economical to have the faulty records punched out. Then, by making the corrections on these cards and deleting the original citations from the tape, an additions run could be made re-adding the corrected citations to the tape.

Ossify recognizes only the /ID/ statement and the /SELECT/ statement which indicates the records to be punched. The record numbers should directly follow the /SELECT/, enclosed in parentheses. If this statement is not present, the entire file will be punched.

APPENDIX A

Rules for Keypunching

Program Control Cards

All control cards begin with a slash in column 1. The control *statement* follows the slash and is closed by a second slash, e.g., /ID/ or /FIELDS/. This rule is invariable. Most control statements are followed by a *text* which contains the particulars to be handled by the program.

The text following many statements is enclosed by parentheses:

```
/FIELDS/(AUTH,TITL,PUB,DATE)
/DELETE/(3, 15-19, 46-68, 101)
/SELECT/(1-500, 575-690)
```

The specific format for the text following a given statement is shown in this handbook at the point the statement is explained.

Some statements have no text, e.g., /ORIGINAL/, /CITATIONS/.

All text, with or without parentheses, is punched following the second slash of the control statement. When it is necessary to continue the text onto a second card, it begins in column 1 of the second card.

Record Data

Field labels are punched in columns 1-4 of the first card in the field. Continuing cards in a field do not carry labels. Actual text of the record begins in column 6 and continues through column 80. If it is necessary to continue onto another card, punching begins in either column 6 or column 7. If the last word of the preceding card had ended in column 80, then punching begins in column 7. If the word was broken in the middle, or if column 80 was a blank separating two words, begin in column 6. Do not use a hyphen in column 80 to break a word if it is not complete; simply punch up through column 80 and place the remainder of the word on the next card beginning in column 6. Famulus will put the split words together at the time of printing.

Records may be up to 4,000 characters long, excluding field labels of which there may be ten or fewer. Since the number of characters placed on a card will vary, there is no fixed number of cards which can make up one record.

Following are some examples of different types of Famulus record formats.

Example 1:

```
AUTH COMPERE, H.
TITL THE RED SCALE AND ITS INSECT ENEMIES.
DATE 1961.
PUB  HILGARDIA, 31(7), 173-278.
KEY  BIOCONTROL, MASS CULTURE, COLONIZATION, HYPERPARASITES
LOC  PROJECT FILE A
```

Example 2:

```
NAME SMITH, MARY
JOB  CLERK TYPIST
SS   546-83-8289
GS   GS-4 (CAREER CONDITIONAL)
DOB  7/21/40
```

Example 3:

```
F1   LAB NOTE 143
F2   LAB 5, BERKELEY
F3   06/13/69
F4   EFFECTS OF SMOG ON PONDEROSA PINE--THIRD STAGE TESTING
F5   RESULTS--DECREASE IN NEEDLE LENGTH AND WATER CONTENT
```

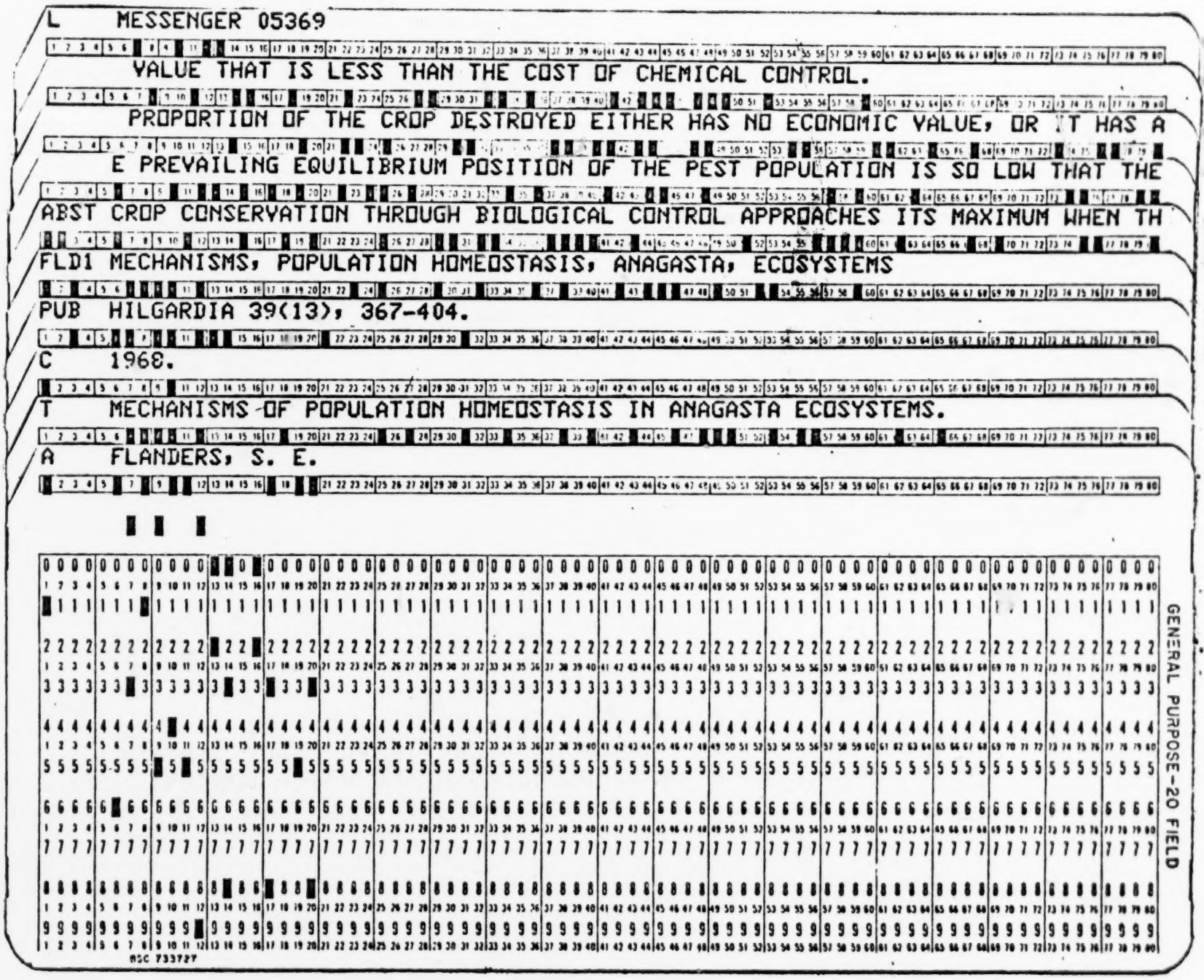
L MESSENGER 05369
VALUE THAT IS LESS THAN THE COST OF CHEMICAL CONTROL.
PROPORTION OF THE CROP DESTROYED EITHER HAS NO ECONOMIC VALUE, OR IT HAS A
E PREVAILING EQUILIBRIUM POSITION OF THE PEST POPULATION IS SO LOW THAT THE
ABST CROP CONSERVATION THROUGH BIOLOGICAL CONTROL APPROACHES ITS MAXIMUM WHEN TH
FLD1 MECHANISMS, POPULATION HOMEOSTASIS, ANAGASTA, ECOSYSTEMS
PUB HILGARDIA 39(13), 367-404.
C 1968.
T MECHANISMS OF POPULATION HOMEOSTASIS IN ANAGASTA ECOSYSTEMS.
A FLANDERS, S. E.
GENERAL PURPOSE-20 FIELD

Plate I. Facsimile of punched cards comprising one citation. Read up.

A	Author
T	Title
C	Date
PUB	Imprint information
FLD1	Retrieval terms
ABST	Abstract
L	Location

APPENDIX B

Control Cards Accepted by Each Program.

(Statements indicated below as "optional" are selected by the user as necessary to accomplish a specific function. Non-optional statements such as /ID/ must be included regardless of the function of the job.)

Edit:

First run:

```
/ID/
/FIELDS/
/DESCRIPTOR FIELD/  (optional)
/ORIGINAL/
/CITATIONS/
```

Update run:

```
/ID/
/NEW ID/              (optional)
/FIELDS/              (optional)
/DESCRIPTOR FIELD/    (optional)
/PRINT/               (optional)
/DELETE/              (optional)
/REPLACE/             (optional)
/CITATIONS/           (optional)
```

Sort:

```
/ID/
/FIELDS/
/SELECT/              (optional)
```

Merge:

```
/ID/
/ID/
/NEW ID/              (optional)
/PRINT/               (optional)
```

Galley:

```
/ID/
/WIDTH/               (optional)
/SELECT/              (optional)
```

Index:

```
/ID/
/SELECT/          (optional)
/PUNCH/           (optional)
```

Vocab:

```
/ID/
/FIELDS/          (optional)
/SELECT/          (optional)
/VOCABULARY/
```

Search:

```
/ID/
/FIELDS/          (optional)
/WRITE TAPE/      (optional)
/SEARCH
```

Ossify:

```
/ID/
/SELECT/          (optional)
```

APPENDIX C

How to Interpret Error Messages

Edit:

The two most frequently occurring error messages are /ID/ DOES NOT MATCH ID ON INPUT TAPE and FIELDS ARE OUT OF ORDER SKIPPING THIS CITATION. The first message is self-explanatory. The second message occurs if the fields are actually out of order, but is also generated if the blank card between citations is omitted. The entire group of cards which is being skipped is set off by asterisks.

Edit also prints the following messages:

ERROR IN ABOVE STATEMENT -- which refers to the control card immediately preceding the error message.

THIS STATEMENT DOES NOT BELONG IN EDIT -- an illegal program control statement has been included.

NEW FIELD LABELS DIFFER IN NUMBER FROM THE OLD ONES -- in renaming the fields, you have either included extra labels or omitted some.

The remaining Edit messages are self-explanatory.

Sort:

Again, the message /ID/ DOES NOT MATCH ID ON INPUT TAPE is the most common. The other messages refer primarily to the /FIELDS/ statement and indicate if it has been omitted, if it declares fields which do not match those on the tape, or if it is incorrectly punched.

Merge:

Merge checks both /ID/'s to see if they match the input tape files names, and prints corresponding messages if they do not.

It also will print an error message and halt, if in the merging process it encounters citations on the tape which are not in alphabetical order.

The program will identify the citation which is out of order and will terminate processing. The tape on which the record was out of order must then be resorted into correct order, and the merge job rerun.

Galley:

Galley recognizes errors on the /ID/ card or any incorrectly included program control cards.

Index:

Index checks for matching /ID/ statement and file name. The only other messages it prints concern whether the /DESCRIPTOR FIELD/ was correctly defined and whether there are included any extraneous program control cards.

Vocab:

Again, the /ID/ message will occur if the /ID/ is not identical to the tape record. If a /FIELDS/ statement does not occur is incorrectly punched, a message will result. The program also prints a message when its dictionary limits are exceeded. If this occurs, in the statistics section following the vocabulary lists, the last citation examined for the listed compilation will be given. Another run can then be set up to process only the remaining citations.

Search:

After checking the /ID/ statement, Search scans the search formula to insure that the logical operators are correctly punched and that parentheses are balanced. If they are not, it will print an error message and terminate the job. It also checks that the formula is a valid one.

Ossify:

Ossify checks the /ID/ and then scans any numbers given in the /SELECT/ statement. If there is a punching error, a message will be printed and execution will halt.

APPENDIX D

Peripheral Programs

These peripheral programs were developed for handling special situations at the PSW library. Mutate converts records punched in the prototype CATALOG program format to a format acceptable by Famulus programs. Famtext converts IBM Datatext-produced files to Famulus format input ready for an Edit run. Locate scans a field containing multiple entries, set off by parentheses, and lists the record information under each entry separately.

Locate is useful in situations where a printout is needed which lists the records of a file under a large number of access points. It will operate on any field of a record which has its content set off by parentheses. A separate description and source deck for Locate is available from the Famulus System Administrator.

APPENDIX E

How to Generate Index Terms

Famulus permits the creation of whatever indexing terms or keywords you need to express your thoughts and concepts without distortion. It is advisable to familiarize yourself thoroughly with the search operations of the system, and to think about their use, before investing great time in development of a vocabulary which you may shortly find inadequate. (But if this happens, the delete and replace operations make correction inexpensive and practical.)

Indexing experience demonstrates that it is best to use the shortest version of a keyword or phrase which gives explicit expression to your concept. This will usually be a compound noun, e.g., MERISTEM REGENERATION rather than an adjectival phrase MERISTEMIC REGENERATION or a noun-phrase like REGENERATION OF MERISTEMS. Users of libraries and standard bibliographies may have an impulse to invert compound terms, e.g., THINNING, NATURAL vs. NATURAL THINNING. Bibliographically this is a complex issue and should be discussed with a librarian. We advise, in general, against inversion. Inversion is necessary and useful in long, visually-displayed files like library catalogs and printed indices. The search efficiency of Famulus is not in any way increased by inversion of terms. However, if you want your printed Vocab lists to reflect standard subject heading lists, then you may certainly use inversion.

Some users do not want to be involved with two alphabets, one from the title field and another from the descriptor field, yet they want to know if there are unexpected retrieval handles in the titles of their records. It is easy, after a significant number of records are in the file, to make one Vocab scan of the title field. From the resulting list, any new, useful terms can be gleaned and transferred to the descriptor field of the proper records.

There are many situations in which standardized lists or thesauri of retrieval terms are very helpful. It is also possible to mix your own special terms into a standard list, thus increasing its value to you. If necessary, you can even draw on several lists at one time. Several standard Thesauri and lists are mentioned here. Your friendly librarian can tell you more about these and still other lists that are available.

THESAURUS OF ENGINEERING AND SCIENTIFIC TERMS. Prep. for the U.S. Dept. of Defense by [the] Office of Naval Research (Project LEX) in joint operation with Engineers Joint Council. Washington, D.C., 1967. 690 p.

(This is the "basic" standard technical Thesaurus. Use of this, plus botanical and zoological names, provides a very inclusive general indexing vocabulary.)

U.S. National Agricultural Library. AGRICULTURAL/BIOLOGICAL VOCABULARY. 1st ed [+suppls.]. Washington, D.C.,]967. Vol. I: Categorized List. Vol. II: Alphabetical List.

(A Thesaurus-like compendium, it is used for NAL indexing and cataloging. Use of the vocabulary where applicable will assure compatibility with Department terminology. Supplements are issued as necessary.)

U.S. Forest Service. ORGANIZING COLLECTIONS BY OXFORD SYSTEM. FSH 1609-14 (formerly 1673.1). Washington, D.C., 1966. var. pag.

(Though this Handbook was written primarily for use with the OXFORD SYSTEM OF DECIMAL CLASSIFICATION FOR FORESTRY, the alphabetical list of index terms was especially designed to be easily adaptable to a Thesaurus. It can be used very effectively by Index and Search in Famulus operations.)

U.S. Dept. of Interior. Office of Water Resources Research. WATER RESOURCES THESAURUS. ...Washington, D.C., 1966. 237 p.

(This is a specialized thesaurus of great value to anyone working in forest hydrology, or in any other aspect of water resources development.)

Other Federal Agencies, such as AEC, NASA, and HEW, have produced, or are producing, Thesauri for their own information handling systems. These may be useful for specialized projects in the Forest Service. Vocabulary lists produced for nomenclatural purposes, rather than indexing uses, may also be used. Most professional societies have their own, e.g., SSSA's GLOSSARY OF SOIL SCIENCE TERMS; American Society for Range Management's ...GLOSSARY OF TERMS USED IN RANGE MANAGEMENT. There are also useful Forest Service publications, such as USDA

Handbook No. 104, GLOSSARY OF TERMS USED IN FOREST FIRE CONTROL, and PNW's ABRIDGED GLOSSARY OF TERMS USED IN INVERTEBRATE PATHOLOGY.

APPENDIX F

Efficient Use of Search

No formal knowledge of symbolic logic or Boolean algebra is required in order to make effective use of Search. But it is necessary for you to understand the basic operations and the search results to which they lead when you use them. Equally important is the understanding which you bring to the process of translating your own natural language question into the terms which index your file records.

Conjunction

The simplest thing you can ask Search to do is to give you a printout of all the records in your file which have a given term in the descriptor field, e.g., Pinus lambertiana. This would result in a printout of the subset of your file containing all your information on Sugar pine (Pinus lambertiana). However, this is not very explicit. Supposed you were looking for material on embryo dormancy in Sugar pine. You would then ask Search to print out those records containing the keywords PINUS LAMBERTIANA *and* EMBRYO DORMANCY. This is a smaller, more explicit subset. The process can be expanded to exhaustion of your file's information specificity, e.g.,

	Question		Search Terms
1.	"Print out everything on P. lambertiana."		PINUS LAMBERTIANA
2.	"Print out everything on embryo dormancy in Sugar pine."	*and*	PINUS LAMBERTIANA EMBRYO DORMANCY
3.	"Print out everything on meristemic regeneration from dormant Sugar pine embryos."	*and* *and*	PINUS LAMBERTIANA EMBRYO DORMANCY MERISTEMIC REGENERATION
4.	"Print out everything on in vitro regeneration of root meristems of dormant Sugar pine embryos."	*and* *and* *and*	PINUS LAMBERTIANA EMBRYO DORMANCY MERISTEM REGENERATION IN VITRO

Each term added to the search formula drastically reduces the size of the subset.

This example corresponds to class conjunction in the algebra of classes. The formula is also commutative. The terms may be listed in any order, separated by the logical signs (as explained on p. 22), e.g.,

EMBRYO DORMANCY ^ IN VITRO ^ PINUS LAMBERTIANA ^ MERISTEM REGENERATION

Note also that the phrases in the Question column have been formalized in the Search formula column. This is advisable but not mandatory. The problem is further elaborated in Appendix E.

Disjunction

This basic operation permits you to set up questions in which you want a printout of those records which contain in their descriptor field *either* one of two terms, *or* both of them. You might wish to see those records containing either EROSION or SLIDES, or both. In actual practice the disjunctive operation is used in connection with conjunctive operations to develop the full potential of Search information retrieval power.

Supposing that you had a file on recreation use problems in national forests and national parks, and that you wanted to see all your records dealing with soil compaction in this context. If you have used NATIONAL FORESTS and NATIONAL PARKS as descriptors, you will want to see all the items in both of these. To ask for NATIONAL PARKS *and* NATIONAL FORESTS would produce only those records which treat of both jurisdictions. Probably most of your records will treat only of one or the other. Your search strategy must be to ask: "Print out everything on national forests or national parks and recreation use and soil compaction. The search formula is:

(NATIONAL FORESTS v NATIONAL PARKS) ^ RECREATION ^ SOIL COMPACTION

Note that the two terms joined by the "or" sign (the disjunctive operator) must be enclosed by parentheses.

Constructing the Search Formula

The keywords or terms to be used in the search formula will be drawn from a vocabulary list. This list may have been generated by Vocab from terms you have put into the descriptor field. In this case, you are working with a controlled list.

You may also have a list generated from the title field. This is an uncontrolled list, because you had no part in the choice of words and word-forms used by the original authors in their titles. If you have two such lists for your file, you must always use the title list for title searches only and the descriptor list for searches on the descriptor field. This is because the list used can influence the construction of the search formula. If you want to search both title and descriptor fields at the same time, then the formula is constructed as if it were for a title search only.

This requirement exists because with an uncontrolled list you must allow for all the grammatical variations of natural language. In many titles common rather than botanical names are used. Ordinary speech phrases like "dormancy of embryos" will appear instead of EMBRYO DORMANCY. These inevitabilities make necessary both truncation and use of the disjunctive operation. The examples under Conjunction (above) were illustrated with keywords from a controlled descriptor vocabulary. Question four, with truncated terms, would give the following conjunctive search formula.

PINUS LAMBERT ∧ EMBRYO DORMAN ∧ MERISTEM REGEN ∧ IN VITRO

If you are searching a title field for the same information, or in conjunction with a descriptor field, you will have to employ the disjunctive operation in order to catch deviant forms in the titles.

(PINUS LAMBERT ∨ SUGAR PINE) ∧ (EMBRYO ∧ DORMAN) ∧
(MERISTEM ∧ REGEN) ∧ IN VITRO

This expands the structure from A ∧ B ∧ C ∧ D to (A ∨ B) ∧ (C ∧ D) ∧ (E ∧ F) ∧ G. What you are now asking for is "Print out everything on Pinus lambertiana *or* Sugar pine *and* embryo[s/nic] *and* dorman[t/cy] *and* meristem[ic/s] *and* regen[erate/eration/erating] *and* in vitro." This will catch deviant forms in titles. It may increase the "noise" in your retrieval by also pulling in some items which are not actually germane to your question. These cannot likely be very many, given the parameters of the language and the structure of formula.

Formula Structures

The basic structures below illustrate possible search formula structures. As in algebraic formulations, increasingly complex structures can be elaborated. It is seldom likely that you will have to develop questions much beyond the structural complexity shown here.

Formula	Result
A	Prints all records indexed by A (either by A alone or with other terms).
A ∧ ¬B	Prints all records indexed by A and by any other terms except B.
A ∧ (¬B ∧ ¬C)	Prints all records indexed by A and by any other terms except B and C.
A ∧ B	Prints all records indexed by both A and B. This structure may be extended as far as necessary, e.g., A ∧ B ∧ C ∧ D, etc.
A ∨ B	Prints all records indexed by A or B, or by both. This structure may be extended as far as necessary, e.g., A ∨ B ∨ C ∨ D, etc.
A ∧ (B ∨ C) ∧ D	Prints all records indexed by A and D, and B or C.
A ∧ B ∧¬(C ∨ D)	Prints all records indexed by A and B and not by C or D.

Examples of Searches

A ∧ (B ∨ C) ∧ D

/FIELDS/(TITL,KEY)
/SEARCH/SOIL STABILITY ∧ (EROSION ∨ SLIDES) ∧
196(DATE)

This search formula will cause the computer to scan the title and keyword fields and retrieve any records containing the phrase SOIL STABILITY and either EROSION or SLIDES. Only records published since 1960 will be retrieved

(A ∨ B ∨ C ∨ D) ∧ E ∧ F

/FIELDS/(DESC)
/SEARCH/(PANCHROMATIC ∨ INFRARED ∨ THERMAL ∨ RADAR) ∧
AERIAL ∧ 70MM

This formula causes the computer to scan the descriptor field and print any records including AERIAL and 70MM, and any one or combination of the terms in parentheses--PANCHROMATIC, INFRARED, THERMAL, or RADAR.

((A ∧ B) ∨ (C ∧ D) ∨ E) ∧ (F ∨ G ∨ H ∨ I)

/FIELDS/(TITL)
/SEARCH/((CLEAR ∧ CUTTING) ∨ (SLASH ∧ DISPOSAL) ∨
SCARIFICATION) ∧ (LODGEPOLE ∨ PONDEROSA ∨ DOUGLAS-FIR
∨ LONGLEAF)

This formula will retrieve records with either CLEAR CUTTING, SLASH DISPOSAL, or SCARIFICATION in the title combined with either LODGEPOLE, PONDEROSA, DOUGLAS-FIR, or LONGLEAF. By using SLASH ∧ DISPOSAL instead of SLASH DISPOSAL, you avoid missing items which might use "DISPOSAL OF SLASH".

(A ∨ B) ∧ C ∧ D

/FIELDS/(TITL,DESC)
/SEARCH/(SPECTROPHOTOMETRY ∨ RADIOMETRY) ∧ CELL STRUCTURE ∧
JONES(LOC)

This search formula will retrieve items including either SPECTROPHOTOMETRY or RADIOMETRY and CELL STRUCTURE which have the name "JONES" in the location field. In other words, the

output will be a list of items in JONES' collection on the subject of SPECTROPHOTOMETRY or RADIOMETRY applied to the study of CELL STRUCTURE.

ADDENDUM

Three options have been added to the FAMULUS system since publication of the User's manual. The options are:

1. To allow a /WIDTH/ specification in EDIT--this option is identical to the one in GALLEY and consists in punching /WIDTH/ in columns 1-7 and following it by the desired number of characters in parentheses.

   Example:

   /WIDTH/(65)

   /WIDTH/(110)

2. To allow GALLEY to print a tape in the EDIT format, i.e., a format which includes the field labels. This is specified by a control card which reads /PRINT BY FIELDS/ beginning in column 1.

3. To allow SEARCH to print only citation numbers rather than the full citation. This option is helpful for jobs going over teletypes or slow printers. This option is specified by a control card which reads /NUMBERS/ beginning in column 1.